REMARKS

Reconsideration and allowance of the above-referenced application are respectfully requested.

Claims 9-13 and 16 stand rejected as not being supported by the original specification. The rejection alleges that the limitation "a set of partial differential equations" does not have support in the original specification. However, the original specification clearly does describe a number of differential equations, and more specifically page 32, line 16, describes defining "a set of linear differential equations". A number of differential equations are described in the specification, with equation 3, for example, explaining that some of these can represent partial differentiation. Therefore, clearly partial differential equations are supported.

However, and in order to obviate the issue, the term "partial" has been removed from the claim.

The term "linear" has been added into claim 16 in order to obviate the rejections thereto.

The objections to claims 22 and 23 are well taken, and these claims have been canceled herein.

Claim 16 stand rejected under 35 USC 102 as allegedly being anticipated by Buchanan. Claim 16 is amended herewith to better emphasize the patentable distinctions thereof. Specifically, one aspect of claim 16 is, as described in the background spanning pages 1-2, based on problems caused when the finite element analysis is calculated by relaxing the continuity requirements. For example, the first paragraph on page 2 reviews published alternative approaches that are based on relaxation of the displacement and/or slope continuity. This has produced inaccuracies in the final model.

Buchanan is apparently similar to that prior art described in the background. Buchanan describes a fourth-order differential equation based on the Kirchhoff theory of plates In paragraph 7.7, Buchanan derives a stiffness matrix for plate bending using the Mindlin theory with a second-order differential operator, see also paragraph 7.17. Buchanan, however, explicitly notes that his element gives good results "without satisfying all continuity requirements" resulting from the Kirchhoff theory of plates. Since Buchanan states that all continuity requirements will not be satisfied, it is apparent that he intends to ignore certain continuities, such as the continuity of the slope. Apparently, therefore, Buchanan intends to satisfy the continuity of the function itself, only.

The amendments to claim 16 emphasize the distinctions over Buchanan's disclosure of relaxed continuity requirements.

In addition, claim 16 defines that the set of differential equations comprises both a stiffness matrix and an external forcing vector. Buchanan does describe a stiffness matrix for example in 7.17. However, nowhere is there any teaching or suggestion of an external forcing vector in addition to the stiffness matrix. Therefore, claim 16 should be allowable for all of these reasons.

New claims 31 and 32 have been added herein to depend from claim 16. These claims define additional aspects which are believed to be patentable over the cited prior art. Claim 31 defines that the external forcing vector defines applied loads on the shell of the unit normal to only a middle surface of the shell . This feature is described generally on pages 10-12 of the specification, which concludes on page 12, just below the equation 20, that the strain measures of interest may be deduced from the deformation of the middle surface of the shell. This produces a significant advantage which is nowhere taught or suggested by Buchanan, or by any of the other prior art. Claim 1 defines the concept of the limit surface described, for example, around page 25 of the specification. The limit surface facilitates calculating certain values when it has these

characteristics, and again, this is nowhere taught or suggested by the cited prior art.

Claims 1-2, 4-5, 9-10, 12-13, 17-18 and 20-21 stand rejected over Groothius in view of the Applicants' admission. In response, each of the independent claims within this group and specifically, claims 1, 9 and 17, have been amended to recite that the differential equations which represent the mechanical response represent at least both of the strain energy density per unit area and an external forcing vector. These claims are also amended to recite that the subdivision basis functions are determined by subdividing the mesh, and recomputing vertex functions of the mesh as a weighted average of several neighboring vertex positions, where the subdivision basis functions are determined by subdividing the shell into a mesh, and recomputing vertex functions of the mesh as a weighted average of several neighboring vertex positions. This emphasizes the patentability over the cited prior art.

While Applicants did admit that Kirchhoff-Love was known, they did not admit, and, in fact, no one in the prior art recognized, that the specific claimed operations could produce unexpected advantages. Specifically, by using a fourth-order differential operator and smooth subdivision shape functions, it is possible to form a model, without relaxing the continuity

requirements. Moreover, however, nothing in Groothius teaches or suggests that the equations represent at least strain energy density per unit area and the external forcing vector. Therefore, it is respectfully suggested that claim 1 should be allowable for these reasons. Claims 27 and 28 which depend therefrom should be additionally allowable over the cited prior art (for reasons stated above), since the prior art does not in any way teach or suggest these features.

Groothius patent describes subdividing an object for obtaining a finite element mesh. Groothius does not, however, describe that the purpose of the subdivision is to generate a smooth surface of a specified type: much less the specific kind of subdivision and vertex arrangement that is now claimed. The present system uses a particular type of subdivision, which successively refine the vertices, to obtain a smooth limit surface. This is accomplished by successively subdividing the mesh and recomputing the vertex positions as the weighted average of several neighboring vertex positions, as illustrated in Figs. 2, 4a, and 4b of the specification. These vertex positions of the coarse control mesh are used for modeling the smooth shell surface.

After this modeling, the mesh is further subdivided as necessary for the purpose of finite element analysis.

Membrane and bending strains are also defined by these claims, as mentioned on pages 11 to 13 of the specification, and defined by the equations 16 and 17. The membrane strains measure the straining of the surface and the bending strains +measure the change in curvature of the shell. The related membrane and bending energies are mentioned, e.g., on page 13 and equation 24.

Therefore, claim 1 should be allowable for these reasons along with the claims which depend therefrom. The remaining claims should be allowable for analogous reasons.

It is believed that all of the pending claims have been addressed in this paper. However, failure to address a specific rejection, issue or comment, does not signify agreement with or concession of that rejection, issue or comment. In addition, because the arguments made above are not intended to be exhaustive, there may be reasons for patentability of any or all pending claims (or other claims) that have not been expressed. Finally, nothing in this paper should be construed as an intent to concede any issue with regard to any claim, except as specifically stated in this paper, and the amendment of any claim does not necessarily signify concession of unpatentability of the claim prior to its amendment.

Attorney Docket No. 06618-505001
Serial No. 09/491,353
Amendment dated July 7, 2004
Reply to Office Action dated April 7, 2004

In view of the above amendments and remarks, therefore, all of the claims should be in condition for allowance. A formal notice to that effect is respectfully solicited.

Please apply any charges or credits to Deposit Account No. 06-1050.

Respectfully submitted,

Date: August 6, 2004

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